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EFFECT OF COMPOST ON THE VARIETY 841 IR SUBMITTED TO THE SYSTEM OF RICE INTENSIFICATION (SRI) AND CONVENTIONAL SYSTEM RICE FARMERS IN SOUTHERN BENIN

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ABSTRACT

The research aims to assess the impact of compost on the performance of SRI versus conventional system; 20 farmers have implemented trials compared between the SRI and the conventional system with or without compost.

For this purpose the experimental design is that of a randomized complete block design with three repetitions and four treatments with or without compost. Thus two parameters such as yield and tillering were studied. The mean of these parameters were statistically compared between the four different treatments using the analysis of variance (ANOVA) and the Mann-Whitney test. From the tests that took place between February and June 2015, the results showed that the SRI with compost gives a yield of 8.1163 t / ha with a mean of 51 tillers while the system with conventional compost gives a yield 5.2417 with a mean of tillers 34. Even without compost, SRI induced a yield of 1. 5063 T/Ha against 0.8557 T/ha for conventional system. Facing the challenge to satisfy the continually soaring food needs, SIR appears as a likely alternative to improve the productivity of the rice in the study area while preserving the environment.

KEYWORDS: Compost, System of Rice Intensification, Conventional System of Rice

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Original Article

INTRODUCTION

Rice, the staple food of more than half of the world population is produced almost everywhere in the world, but more concentrated in Asia and it is only 7% of husked rice production volume which is internationally traded, making the global rice market a surplus management market (FAO, 2012).

Faced with intense pressure on its land and water resources, Asia would be unable to supply rice in the world in the future. This reflects a reduction of the production capacity of the main producers and explains a growing demand (AfricaRice, 2011).

Population growth coupled with the effects of climate changes explain the gradual decline in the supply of rice for 10 years by OXFAM (2010). Many efforts have been made to increase the supply of rice in the West African region but the demand for rice increases at an annual rate of 5 to 6% while production is growing only by 3.2% (Africa Rice, 2011; Seck et *al*, 2013). It will be interesting to find another alternative production in order to fill this gap. For ECOWAS (2012), Africa needs to stake on the productivity of land to reduce the gap between the

potential yield and that of the farmers. Like the other african countries, the Beninese national production covers only 60% of the rice requirements (APR, 2011). The work of Verlinden & Soulé (2003), Capo-Chichi (2004), Adegbola & Sodjinou (2003) and more recently AfricaRice (2011) emphasize among others as major problems, low yields that are less than 3 tonnes per ha against 6-7 tons in Asia. It is necessary to find more intensive production methods.

The objective of this study is to highlight the effect of compost on yields of rice in SRI and conventional system on the farm "farm Kakanitchoé S.A.IN School." It is located in the Kodé District, Municipality of Adjohoun which covers an area of approximately 308 km2 (Gbenou, 2013) at a latitude between 6 ° 50 'and 6 ° 35' N and longitude between 2 ° 35 'and 2 ° 25'E (Figure 1).

MATERIALS AND METHODS

This study which is part of the series of tests conducted by the Cooperation Council of Benin's rice farmers in order to test by themselves and for themselves agronomic performance of SRI makes object of great debates in the scientists' world. Intentionally some parameters as the rate of fertile tillers, plant height, length of panicle already treated several times have not been considered. Thus two parameters such as yield (number of grains and grains weight) and tillering (number of tillers per hill and fertile tillers rate) were studied.

Fifteen rice farmers participated in follow-up testing, four (4) permanently and the other eleven (11) in the steps of providing compost on the parcels, picketing, transplanting, counting tillers, weeding and harvesting.

Plant Material and Technics

The plant material is composed of a single variety of upland rice / irrigated (IR 841) which is submitted to different treatments in a real environment. As for the technics, they consist of well-rotted compost, which is subject to different treatments in the intensive rice system and the conventional system (farmer practice).

Production of Seedlings

A seed-bed has been installed in the experimental site on a land of 10 m^2. The plants are watered daily morning and evening. The seedlings were transplanted SRI after twelve days at one plant per hill against three plants per hill planted to 24 days for plants of conventional rice (as the middle of practice).

Experimental Device

The experimental plantings has been established in a complete random block with three repetitions and four treatments with or not compost. The treatments consist of SRI with compost, SRI without compost conventional with compost and conventional without compost. Each treatment was installed in plots of 10 m2 (5 m long and 2 m wide) each. The distance between two plots of the same block is 1 m and 2 m between the blocks (see diagram of experimental device). The experimental area is 209 m2 (19 m long and 11m wide) including spaces to do the maintenance. For treatments that are submitted to the contribution (12T / ha) of well-decomposed compost are distributed evenly over the entire surface of each bin, making a total of 72 kg for the whole test (T1 and T3) 5m (Figure 2).

Contribution of Compost on Plots and Picket

Just after the delimitation of plots, that is to say during paddling, compost has been made to ensure a good mix with the mud. For SRI, the cords provided with remote nodes 25 cm long are used for the spacing between plants and between lines. Pickets are placed on along the chalk line of these conventional systems, transplanting of seedlings is made in crowds.

Counting Tillers and Plants Height per Treatment

For counting the number of tillers, 10 plants of each treatment were randomly selected and the center of each plot two weeks after transplanting to avoid edge effects. The number of tillers at each planting hole is recorded each week until the beginning of flowering. Similarly, it was also a question of determining the number of fertile tillers (tillers bearing inflorescences) per pocket as more tiller, the greater the performance is better.

Measuring the Weight of the Harvested Grain

The grain harvest was done when 80% of panicles grains have reached full maturity (harvest maturity that is to say when the grains leave the dough stage to mature stage or hard grains). It was carried out on a plot of 1m2 unit for all treatments. The yield obtained at each treatment is evaluated by the quality and quantity of harvested grains. For this purpose, grain quality is assessed by the number of full grains, empty and defilement. However, as to the quantity, weight of grains is also found just after harvest and processing in order to appreciate in both systems (SRI and conventional system) the effect of compost on rice yield.

For data collection, the sheets were developed to record the possible settings. The parameters were:

- Number of tillers per hole;
- The rate of fertile tillers;
- The number of filled seeds, empty and dirt per panicle and plant;
- The weight of the harvested grain.

Statistical Analyses

The average of the different rice plant development cycle parameters and the average weight of the crops are statistically compared between the four different treatments using analysis of variance (ANOVA) in the software R version R i386 3.2.3 or SAS 2009. As the sample size was small, the Mann-Whitney / Wilcoxon Two-sample were used.

Table 1 summarizes the various factors driving tests.

The results obtained after the experimental tests conducted by the rice are shown in the following section.

RESULTS

The essentially agronomic results of this study have been analyzed and were about parameters such as number of plants, average tillers by seed-hole and yield.

Table 2 summarizes data on transplanting and tillering of rice.

An analysis of the relationships between variables shows a strong correlation between the number of plants and

the system of culture (SRI or conventional). This correlation is measured by the rate of Kendall's which give -1,which was confirmed by the Yates correction test (test 2 CHI) which gives 8.333 with a (probability = 0.003) and Fisher (probability = 0.002). SRI with a contribution of 12 t / ha of compost gives a yield of 8.1163 t / ha while the same system without compost has an average yield of 1.5063 T / Ha. In short, the IRS gives a yield 5.38 times better in the same condition than the IRS without compost.

From this table, it emerges some major facts:

IRS with compost has a greater tillering (51.33 / 29 = 1.41 times) than without compost. This relationship between the numbers of tillers is of 2.9 (2.9 = 29/10) and the conventional system with compost and 5,133 times more than the conventional system without compost. Although SRI has used about seven (7) times less than conventional plants during transplanting and the harvesting, the number of ears per square meter is higher. The seed-hole with a single plant for the SRI produced 5 times more tillers that seed-hole with three (3) plants.

That demonstrates the ability of the rice plant to compensate for low feet stands (Figure 3).

Both parameters as the tillering, the yield have confirmed the SRI performance over conventional systems: levels of yields vary between 855 kg and 8116 kg / ha, an increase of 9.49 times of the performance.

- SRI with compost (12 t / ha) has given a yield 5.38 times better in the same condition as the IRS without compost.
- The conventional system with compost was6 times higher than the conventional System without compost. Statistical analysis of the yield of the two systems studied by the Mann-Whitney / Wilcoxon has shown a significant difference (P or probability value = 0.0156) at the 0.05 level. These results need to be discussed.

DISCUSSIONS

This work confirmed the agronomic performance of SRI on conventional (Uphoff, 2004; Styger, 2011; Gbenou, 2013). We have noted that under whatever the culture conditions (with or without compost) the improvement of yield is not only of compost's effect because SRI methods are as rice cultivation system are themselves the principal factors. (Mati and al., 2011). In fact, the IRS from farmers reported equivalent yields to those of the green revolution (69-258% compared to controls) without mobilizing synthetic chemical inputs (Uphoff, 2005; Stopp and al., 2002; Bockel, 2005; Serpentié, 2013).

If the compost significantly improves performance, its mobilization remains high constraints and an important determinant of the level of adoption of SRI (Bockel, 2005; Dabat and al., 2007; Gbenou, 2013). Analysis of the results of the plots, where it has not made compost, highlights this reality. Indeed, the differential performance between the plots cultivated with or without compost is about 93%.100% of farmers who participated in these trials thought that access to compost remains a major constraint limiting the adoption of SRI "strict". The work of Dabat et al. (2007) in Madagascar, Styger (2011) in Mali or Mati and al., (2011) in Kenya also reported this difficulty in using SRI methods. The key issues are how to successfully produce good quality of compost and where to do it in order to reduce transport costs until the field.

CONCLUSIONS

SRI methods as rice cultivation system are determinant factors which can improve the performance of this cereal.

SRI with compost gives a yield of 8.1163 t / ha while the conventional compost without giving a yield of 0.5377 t / ha. Thus the practice of SRI methods would induce significantly the increase of the national rice supply.

The producers were very enthusiastic in regards of these results but they wonder how to successfully mobilize significant amounts of compost and transport it up the farm. Access to compost in quantity and quality is a major limiting factor for those who want to adopt the SIR. It is a very good technic in theory, but it is not often realistic on large fields; and even if all the world's researchers say that it's very good, farmers are struggling to use it widely. According to some farmers it is not easy to produce compost. This is what emerges from the statement of Daniel, rice farmer in Kakanitchoé.

Box 1: Daniel about the Difficulty of Mobilizing the Compost

"Producing compost is expensive (labor, water in areas where it does not rain enough) while researchers naively reason as if it were free."

Producers, while enjoying the agronomic performance of SRI, are faced² the very pertinent question of the feasibility of SRI "strict" according to different ecologies and farm types.

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APPENDICES

Table 1: Test Factors in Field

Type of Rice	Number of Repetitions	Plots Area (2 M X 5 M)	Number of Weed Control	Length of Stay in Seed-Bed	Number of Plants by Seed-Hole	Plants Spacing
SRI with compost	03	10m²	4 times	12 days	**1**	25cm X25 cm
SRI with compost	03	10 m²	4 times	12 days	**1**	25cm X25 cm
Conventional with compost	03	10 m²	4 times	24 days	**3**	In crowd
Conventional with compost	03	10 m²	4 times	24 days	**3**	In crowd

Source: experimental data, in 2015.

Table 2: Average Tillers per Hill, Number of Plants and Yield

Treatments	Number of Plants	Average Tillers by Seed-Hole	Yield (T/ha)
SRI with compost	160 000	51 (±1,528	8,1163(±0,0882)
SRI without compost	160 000	36 (±1)	5,2417 (±0,134)
Conventional with compost	333333	20 (± 2)	1,5063(±0,0781)
Conventional without compost	333333	14 (± 1)	0,8557(±0,0489)

Source: Field Data Analysis, 2015.

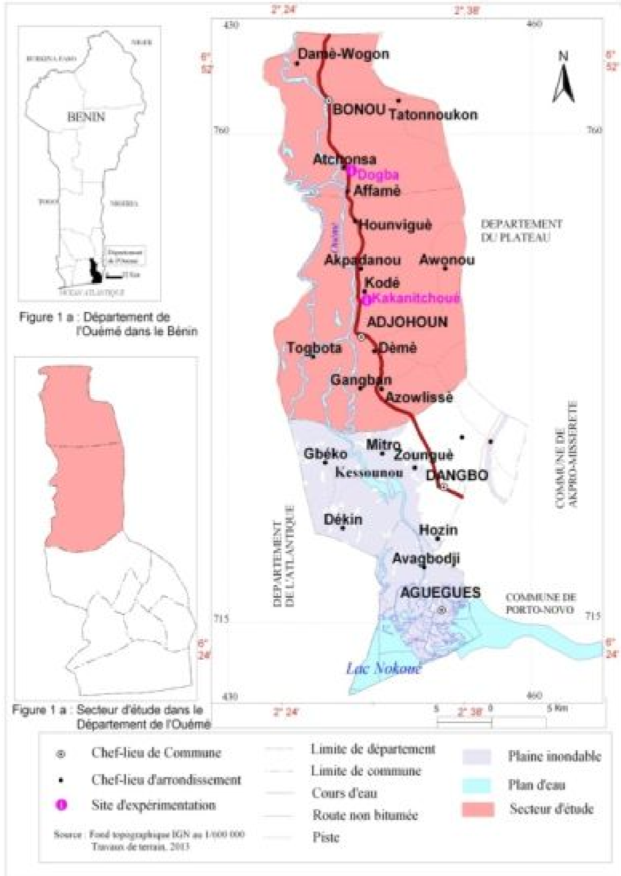

Figure 1: Location of the Farm "Farm S.A.IN School Kakanitchoé"

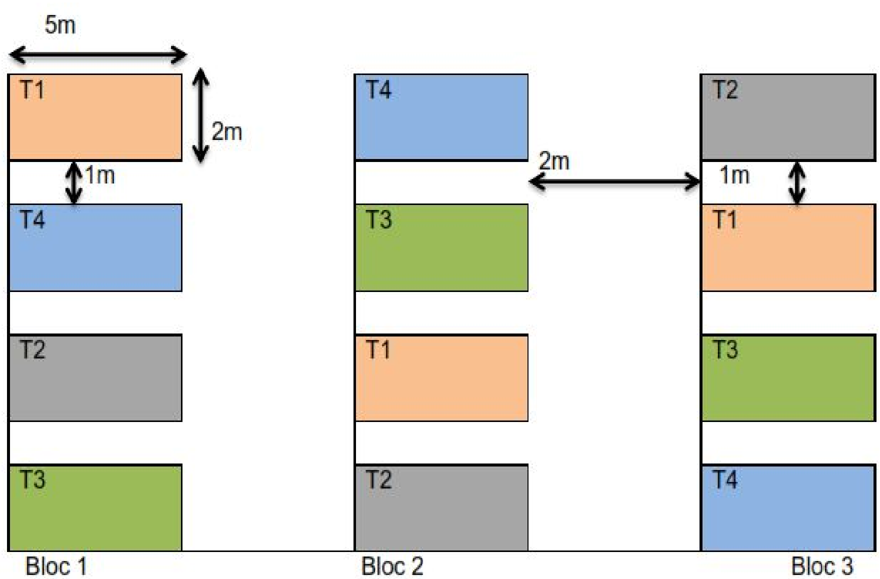

Figure 2: Schematic of the Experimental Detailed

T1 = SRI with compost

T2 = SRI without compos

T3 = Conventional with compost

T4 = Conventional without compost

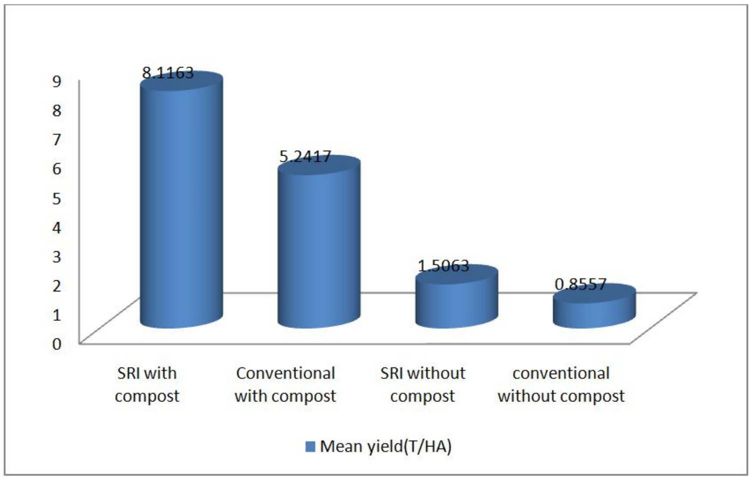

Figure 3: Average Rice Yields (Tons per Hectare)